

Appl. No. 09/818,123  
Amended Appeal Brief dated September 21, 2007  
Reply to Office Action of March 14, 2007

Appl. No. : 09/818,123  
Applicant : Frank Sauer  
Filed : March 27, 2001  
Title : Augmented Reality Guided Instrument Positioning  
With Depth Determining Graphics  
Art Unit : 2628  
Examiner : Motilewa Good Johnson  
Docket No. : 2001P05535US01

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Commissioner for Patents  
PO Box 1450  
Alexandria, VA 22313-1450

### **AMENDED APPEAL BRIEF**

Sir:

This amended brief is in support of the June 12, 2007 notice of appeal of the final rejection of the claims. Amendments to the brief have been made in response to the Notification of Non-Compliant Appeal Brief mailed on September 5, 2007.

(i) Real Party in Interest

Siemens Corporate Research, Inc., Princeton, N.J.

(ii) Related Appeals and Interferences

None.

(iii) Status of Claims

Claims 31-40 are pending in this application. Claims 1-30 have been canceled. Claims 31-40 stand rejected.

The rejection of claims 31-40 are appealed.

(iv) Status of Amendments

A request for reconsideration after final rejection, submitted on May 3, 2007 was entered by the Examiner. No amendments have been filed subsequent to final rejection.

(v) Summary of the Claimed Subject Matter

An augmented reality system allows a user to determine the depth of an instrument being inserted into an object from an external perspective. An augmented reality view is presented by overlaying a virtual graphics guide onto a real view of the object and an instrument. The graphics guide comprises a virtual depth marker located outside of the object. The instrument is aligned to the graphics guide. The instrument is inserted to a depth determined in the augmented view by alignment of a predetermined feature of the instrument with the virtual depth marker. The feature is located along the length of the instrument at a certain distance from the instrument tip and remains external to the object during insertion.

Two independent claims are involved in the appeal:

**Independent claim 31** is directed to a method for augmented reality guided positioning of a real instrument tip within a real target located in a real object. A general representation including the method is shown in FIG. 27 of the present application, and described in the present specification at p. 55, line 15 – p. 56, line 19. The real target located in a real object may, for example, be a mass for which a biopsy is desired (p. 52, line 10) located in a patient (p. 52, line 21).

In the claimed method, an augmented reality view is presented by overlaying a virtual graphics guide onto a real view of the real object and a real instrument (p. 16, line 20 – p. 17, line 1). An example of such a guide is guide 2510 shown in FIG. 25 (p. 54, line 16). The guide includes a virtual depth marker, such as the marker 2500 of FIG. 25, located outside the real object (p. 53, lines 24-26). A real instrument, such as those shown in FIG. 26, is aligned to the graphics guide (p. 53, lines 18-22).

The real instrument is inserted to a depth determined in the augmented view by alignment of a predetermined real feature of the real instrument, such as features 2610, 2620, 2630, 2640 shown in FIG. 26, with the virtual depth marker (p. 51, lines 18-20; p. 53, line 22 – p. 54, line 1). The real feature is located along the length of the real instrument at a certain distance from the real instrument tip (FIG. 26; p. 51, lines 23-26). The real feature of the real instrument remains external to the real object during insertion (p. 53, line 22 – p. 54, line 1).

**Independent claim 36** claims an apparatus for augmented reality guided instrument positioning of a real instrument tip within a real target located in a real object. A generalized apparatus according to the invention, including many optional peripheral elements, is shown in FIG. 2.

The apparatus includes a virtual graphics guide generator and positioner 280 (FIG. 2; p. 16, lines 2-13) for generating and positioning a virtual graphics guide. Illustrative graphics guides are shown in FIGS. 24 and 25. The graphics guide includes a virtual depth marker such as marker 2400 of FIG. 24 and marker 2500 of FIG. 25 (p. 54, line 6 – p. 55, line 2). The marker is located outside of the real object (p. 53, lines 21-22).

A rendering device 220 (FIG. 2; p. 16, line 20 – p. 17, line 1) is for rendering the virtual graphics guide into a real view of the real object and a real instrument. The virtual graphics guide is rendered such that the real instrument can be inserted to a depth determined in the augmented view by alignment of a

predetermined feature of the real instrument with the virtual depth marker (p. 51, lines 18-20; p. 53, line 22 – p. 54, line 1). The real feature, as illustrated by the markers 2610, 2620, 2630, 2640 shown in FIG. 26, is located along the length of the real instrument at a certain distance from the real instrument tip (p. 51, lines 23-26). The real feature of the real instrument remains external to the real object during insertion (p. 53, line 22 – p. 54, line 1).

(vi) Grounds of rejection to be reviewed on appeal

- (1) Obviousness of claims 31-40 as unpatentable over an article entitled "The Expert Surgical Assistant: An Intelligent Virtual Environment with Multimodal Input" (Billinghurst) in view of U.S. Patent No. 6,470,207 (Simon).

(vii) Argument

Billinghurst and Simon Do Not Render  
The Claims Obvious as They Do Not Teach  
All of the Claimed Elements

Claims 31-40 stand rejected under 35 U.S. C. §103 (a) as obvious in view of an article entitled "The Expert Surgical Assistant: An Intelligent Virtual Environment with Multimodal Input" (Billinghurst) in view of U.S. Patent No. 6,470,207 (Simon). "To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art." M.P.E.P. §2143.03 (8<sup>th</sup> Ed., rev. 4, October 2005), p. 2100-139, citing In re Royka, 490 F.2d, 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974) [emphasis in original]. The cited references fail to teach all of the limitations in the claims.

Billinghurst discloses a system for addressing instrument location and navigation that tracks the location of the instrument through images. Billinghurst

does not teach or disclose "inserting the real instrument to a depth determined in the augmented view by alignment of a predetermined real feature of the real instrument with the virtual depth marker, the real feature being located along the length of the real instrument at a certain distance from the real instrument tip, and remains external to the real object during insertion" as recited in independent claim 31. Nor does Billinghamhurst teach or disclose "a rendering device for rendering the virtual graphics guide onto a real view of the real object and a real instrument such that the real instrument can be inserted to a depth determined in the augmented view by alignment of a predetermined real feature of the real instrument with the virtual depth marker, the real feature being located along the length of the real instrument at a certain distance from the real instrument tip, and remains external to the real object during insertion" as recited in independent claim 36.

In the analysis of claims 31 and 36, the office action recites "the graphics guide comprising a virtual depth marker located outside of the real object (figure 2.0, pp. 596)". The referenced image shows a trajectory for instrument movement based on a defined starting point. There is no virtual depth marker external to the object and Billinghamhurst does not teach or disclose a real instrument having a real feature that is aligned with the virtual depth marker and which remains external to the real object (i.e., anatomical structure). The instrument tip is marked on the images in Billinghamhurst with a cross which moves according to the user's instrument motion. The CT scan also changes in response to instrument depth, so the current images are those corresponding to the instrument tip location within the nasal cavity. Billinghamhurst uses this tracking mechanism to monitor the position of the instrument.

Simon discloses a surgical navigational guidance system which uses one or more fluoroscopic x-ray images. Simon uses a virtual cone as a mathematical reference to the volume that is being imaged by the X-ray imaging system. The location and opening angle of the virtual cone determine the field-of-view of the

X-ray system. Simon determines the coordinates of the virtual cone with respect to the coordinate system of the tracking system so that he can overlay a virtual model of the tracked instrument spatially correct onto the X-ray image of the patient's anatomy. Tracking of the instrument is a prerequisite for Simon's method.

Like Billingham, Simon does not teach or disclose the claim elements recited in independent claims 31 and 36. The virtual cone is not shown to the user and therefore cannot provide any guidance to the user; in particular, it does not serve as a virtual depth marker. As indicated in column 12, lines 10-23, the virtual cone is known in the coordinate system of the tracking system. The cone is used to understand the spatial relationship of the X-ray system's field-of-view with the tracked position of the instrument, which allows one to indicate the instrument position (known to the system by instrument tracking) in the fluoroscopic image with a virtual instrument. The virtual instrument can be used by the physician to guide the trajectory of the real instrument. Simon does not align a real feature of the instrument with the virtual marker in order to insert the instrument to a predetermined depth.

The office action also refers to column 7, lines 49-51 where Simon discloses an instrument embedded with infrared emitters or reflectors. The infrared emitters or reflectors are different from the real feature recited in the claims because they do not remain external to the object and the infrared emitters are used with a tracking sensor (see col. 7, lines 45-61) to communicate to a computer the location of the instrument. The emitters would be located on the part of the instrument that is inserted into the body to assist in tracking the movement of the instrument within the body.

The combination of Billingham and Simon lack all of the claimed elements and thus the claims are not obvious in view of this art. Since both Billingham and Simon fail to teach, disclose or suggest aligning a virtual depth marker with a real feature of a real instrument such that the real feature remains external to the

real object during insertion. Claims 32-35 and 37-40, being dependent upon independent claims 31 and 36 respectively, are also not taught, disclosed or suggested by the combination of Billingham and Simon. The combination suggested here is deficient and ineffective as the references, individually and in combination, fail to teach all of the claimed elements. Additionally, there is no teaching or suggestion in any of the references to modify them in such a manner that would result in the claimed invention.

Conclusion

Since the references do not teach, suggest or disclose all of the claimed elements, the rejection under §103 cannot stand and the claims therefore are distinguishable over the cited art. The applicants respectfully request that the Board reverse the examiner and direct that the application be passed to allowance.

Respectfully submitted,



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(viii) Claims Appendix

31. A method for augmented reality guided positioning of a real instrument tip within a real target located in a real object comprising the steps of:

presenting an augmented reality view by overlaying a virtual graphics guide onto a real view of the real object and a real instrument, the graphics guide comprising a virtual depth marker located outside of the real object;

aligning the real instrument to the graphics guide;

inserting the real instrument to a depth determined in the augmented view by alignment of a predetermined real feature of the real instrument with the virtual depth marker, the real feature being located along the length of the real instrument at a certain distance from the real instrument tip, and remains external to the real object during insertion.

32. The method of claim 31 wherein the presenting step further includes interactive planning which comprises the steps of:

determining an optimal location for the real instrument with respect to the real target;

calculating the proximity of the predetermined portion of the real instrument to the real target based on the optimal location and the geometry of the real instrument;

using the proximity calculation to determine the position of the virtual depth marker on the virtual graphics guide.

33. The method of claim 32 wherein the proximity calculation comprises a range a proximity measurements.

34. The method of claim 32 wherein the proximity calculation corresponds to a final forward position of the predetermined portion of the real instrument with respect to the real target.
35. The method of claim 32 wherein the proximity calculation corresponds to a distance between the virtual depth marker and a point within the real target.
36. Apparatus for augmented reality guided instrument positioning of a real instrument tip within a real target located in an real object comprising:  
a virtual graphics guide generator and positioner for generating and positioning a virtual graphics guide, the graphics guide comprising a virtual depth marker located outside of the real object; and  
a rendering device for rendering the virtual graphics guide onto a real view of the real object and a real instrument such that the real instrument can be inserted to a depth determined in the augmented view by alignment of a predetermined real feature of the real instrument with the virtual depth marker, the real feature being located along the length of the real instrument at a certain distance from the real instrument tip, and remains external to the real object during insertion.
37. The apparatus of claim 36, wherein said virtual graphics guide generator and positioner determines an optimal location for the real instrument with respect to the real target, and calculates the proximity of said predetermined portion of the real instrument to the real target based on the optimal location and the geometry of the real instrument.
38. The apparatus of claim 37, wherein the proximity comprises a range of proximities and said virtual graphics guide generator and positioner determines an optimal range of locations for the predetermined portion of the real instrument

with respect to the real target, and calculates the range of proximities of the predetermined portion of the real instrument to the real target based on the optimal range and the geometry of the real instrument.

39. The apparatus of claim 37, wherein the proximity corresponds to a final forward position of the predetermined portion of the real instrument with respect to the real target.

40. The apparatus of claim 36, comprising further a display device to display the augmented view rendered by the rendering device to the user.

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(ix) Evidence Appendix

Not Applicable.

(x) Related Proceedings Appendix

Not Applicable.